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(54) **Squeegee for screen printing machine.**

(57) A squeegee structure for a rotary screen printing machine comprising a fixed portion (1) forming the main supporting element, said portion being adjustable in position, the squeegee further comprising a moveable intermediate member (2) such as a blade of resilient spring steel connected along one edge to said fixed portion, an element (4) of synthetic material having an invariable shape and a smooth and hard surface being mounted on the opposite edge of said blade.

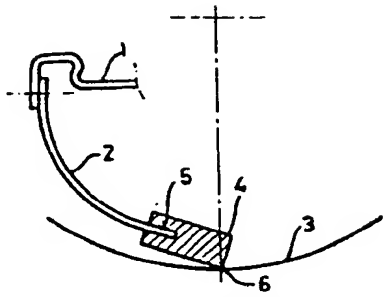

Fig. 1.

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Squeegee for screen printing machine.

The invention relates to a squeegee for pressing a paint-paste through a sieve of a printing machine, especially a rotary screen printing machine for printing a web of material in which the squeegee is composed of an adjustable fixed portion, a movable intermediate member and a part which during printing presses the paint-paste through the sieve, said part of the squeegee consisting of a material having a low coefficient of friction and a high wear resistance.

Such a squeegee is described in the Netherlands Patent Application 73.13509 (corresponding to GB-PS 1.437.756). In this known squeegee a resilient metal blade is provided at its operative edge with a strip of material having a low friction under non-dry circumstances. The application of such a material is of particular interest for avoiding vibrations in the squeegee blade, especially during the occurrence of so-called boundary lubrication between the squeegee blade and the stencils of the screen printing machine.

For the good operation of a squeegee in a screen printing machine it is required that the part of the squeegee co-operating with the stencil causes reduced friction.

Consequently the material should have a low coefficient of friction. Further it is necessary for this material to have a considerable wear resistance as the squeegee continuously brushes past the inner wall of the stencil. The material should also have a reduced initial friction.

A drawback of this type of coating material known from the above mentioned reference consists in that it is rather difficult to apply this material by gluing. This gluing is necessary as soon as a metal squeegee blade has to be provided with a coating of a material with a low coefficient of friction and a considerable wear resistance.

It is a first object of the invention to improve a squeegee comprising this type of coating material such that a wedge-shaped nip angle can be applied at the tip of the squeegee, which angle is not influenced by the elastic deformation. The nip angle of the squeegee should only be variable by an angular adjustment of the intermediate member with respect to the stencil. This angular position should remain constant after an optimum adjustment of this nip angle whereby the contact pressure of the squeegee upon the stencil should remain variable.

According to the invention this aim is realised in the squeegee of the type mentioned before in that the part of the squeegee which is intended to co-operate with the screen,

consists of an element of synthetic material having an invariable shape with a hard and smooth surface, which element is supported relative to the fixed portion in a resilient manner. This has the advantage that a correct functioning of the squeegee can be obtained without suffering a deformation of the squeegee. Moreover the advantage is obtained that in each printing situation an optimum condition of the squeegee relative to its nip angle and pressing force can be pre-adjusted and maintained during operation. This adjustment of the squeegee is determined by the printing result as required by the printer, such as much or little penetration, much or little paint deposition, whilst moreover the following criteria can be taken into account: the required sharpness, the character of the substrate to be printed such as cloth, paper etc., the openness, the thickness and the moist absorbing capacity of the cloth, the spreading behaviour of the printing-paste, the fineness and the perviousness of the stencil, the printing velocity and further factors. Depending upon all these desiderata, a special nip angle or wedge-shape should be chosen to obtain an optimum result. This is possible with the squeegee comprising the features as recited above in which the shape of the synthetic element can be determined at will.

According to a further aspect of the invention, the element of synthetic material can be mounted in or around a fitting

which is yieldable with respect to the fixed but adjustable portion of the squeegee. It is also possible that the element itself is yieldingly mounted to the fixed portion.

According to still a further aspect of the invention, the squeegee is embodied such that the face of the element of synthetic material which is in contact with the paint-paste is lying flush with the side of the moveable intermediate member turned towards the stencil.

The application of the non-deformable element of synthetic material according to the invention renders it possible to obtain a particular embodiment of the squeegee by applying a resilient cushion between the element of synthetic material and the intermediate member on the one hand and the fixed portion of the squeegee on the other hand.

It is observed that it is known per se to apply with a squeegee an elastic cushion, vide for instance the US-PS 3,930,445, 3,878,780 and 3,795,188. However in these known squeegees one always uses a slideable pressure bar between the resilient cushion and the squeegee blade, so that inevitably friction will occur, so that the pressing force exercised by the cushion cannot be accurately determined.

In a particular embodiment of the squeegee according to the invention either the element of synthetic material is incorporated in the elastic cushion, or the cushion is incorporated in the intermediate member.

Specific embodiments of the invention will now be described by way of reference to the accompanying drawings in which:

Fig. 1-6a are transverse sections through different embodiments of a squeegee for a rotary screen printing machine.

Fig. 7 is a section of a squeegee comprising an elastic cushion.

Fig. 8 is perspective view of a squeegee with an elastic gas cushion.

Fig. 9 shows a one-piece-squeegee comprising an elastic cushion.

Fig. 10 and 11 are two further embodiments of a squeegee with a fluid cushion.

Fig. 12 and 13 show two variants on an enlarged scale of a mounting structure of the synthetic element to a thin squeegee blade.

The Fig. 1-6 show an adjustable but fixed portion 1 known per se of a squeegee, provided with a yieldable and elastic blade 2 for instance of steel. The squeegee co-operates with a base which in the present case consists

of a stencil 3 of a rotary screen printing machine. The element 4 of the squeegee co-operating with the stencil 3 is embodied as a profiled strip which according to Fig. 1, has the shape of a rectangular prism. The narrow side of this prism has a recess 5 in which the edge of the blade 2 fits. The lower edge 6 of the strip 4 constitutes the brushing edge and this embodiment is chosen in case the printer wants a variable nip angle or wedge with a long upperside of the nip in order to obtain a substantial paint deposition.

In the prismatic shape according to Fig. 2 the strip 4 is also rectangular in cross section, but the narrow side 7 is directed towards the stencil 3. This embodiment will be chosen when the printer wants a very sharp printing result with a reduced deposition, requiring a short upper surface of the wedge.

Fig. 3 shows a strip 4 having a curved side 8 forming the upper boundary of the wedge. In this embodiment the nip angle is greatly variable and a considerable deposition can be obtained. It is also possible to keep the nip angle constant under all circumstances when instead of a curved face 8 with an edge 6, a completely curved operative face 9 is applied, as shown in Fig. 4. The curvature of this face 9 continues beyond the contact zone 10 as indicated with the reference number 9a. In this embodiment the pressure

force can be varied under a constant nip angle whereby the quantity of the printing paste which is deposed through the stencil is constant. By means of the variable pressure force, the penetration depth of the printing paste can be adjusted.

In order to obtain a greater penetration than is possible with the embodiment according to Fig. 2, the strip 4 can be provided with a second brushing edge 11 in addition to the edge 6. The part of the lower face of the strip 4 lying between the edges 6 and 11 is provided with an additional wedge face 12, vide Fig. 5. The adjustment of this squeegee is somewhat critical, but is at any rate feasible between practical boundaries. In this embodiment it is possible to obtain a very considerable penetration.

In the embodiment according to Fig. 6 it is possible to obtain a great deposition in consequence of a high pressure within the paint by means of a strip 4. This strip 4 has an angular lower face forming the upper boundary of the wedge, said face consisting of a portion 13 and a portion 13a. The nip angle of this latter portion is very reduced. The strip 4 can also be provided with a separate insert 4a the edge 6 of which is brushing the stencil, vide Fig. 6a.

The above described variants are possible in consequence of the fact that the brushing edge co-operating with the base

(the stencil 3) forms part of an element of invariable shape. This element 4 is connected to the fixed portion 1 of the squeegee through the resilient blade 2. This was not possible up till now with the known squeegees composed of a resilient blade comprising whether or not a low-frictional coating.

In the particular embodiment according to Fig. 7 the strip 4 is directly connected through a pivot 14 with the fixed portion or girder 1. Between this portion 1 and the element 4 a resilient cushion 20 containing a fluid is accommodated. In the embodiment according to Fig. 8, the element 4 is mounted by means of ridges 16 behind a frame 18 forming part of a blade 15. This dove-tail structure serves to keep the strip 4 at its correct place. The strip 4 has an edge 17 brushing the stencil 3. The plate 15 comprises a pivot 19 for connection with the portion 1 of the squeegee.

The position of the fixed portion 1 is in a manner known per se adjustable prior to the printing operation. Between the plate 15 and the portion 1 an elastic cushion is accommodated embodied by an inflatable gas hose 21. Through the adjustment of the pressure in the hose 21, the pressing force of the strip 4 against the base 3 can be determined. By applying the profiled strip 4 a correct and uniform repartition of the pressure is obtained. This pressure is

dependent upon the requirements of the printer in connection with the non-uniformity of the cloth etc. In order to keep the working conditions of the squeegee as uniform as possible along the entire operating length of the squeegee, it is possible to divide the hose 21 into sections, thereby applying slightly different pressures in the subsequent sections of the hose. Abrupt transitions do not occur in consequence of the fact that the strip 4 has an invariable shape.

The fluid in the hose can either be a liquid or a gas. It is to be noted that the pressure of the squeegee can be adjusted without any alteration in the nip angle of the squeegee. Moreover the invention renders it possible to obtain a stepless change in the fluid pressure during the printing operation. In this manner it is possible to obtain a considerable "brilliance" with the printing paste upon the upperside of the cloth with little penetration by means of a low pressure. By increasing the pressure the penetration also increases so that relatively less paste is lying on the upper face of the cloth by applying a high pressure within the cushion. A gradual and stepless change from one type of printing result to the other type is obtainable in the squeegee according to this invention. It is thereby not necessary to apply squeegee blades of different rigidity.

When the printer wants to use a relatively stiff squeegee, it is possible to apply a stiffening in the strip for instance a metal tape 24 as indicated in Fig. 9. The same Fig. 9 shows the possibility to incorporate the elastic cushion 21 within the material of the strip 4. In the same manner as described relative to Fig. 8, the cushion 21 is filled with fluid under pressure. The embodiment according to Fig. 9 has been manufactured by extrusion moulding by means of which two flanges 22 are manufactured which are secured upon the fixed portion 1 by means of strips 23. It is also possible to combine the profiled strip with the fixed portion and a cushion, which cushion may be manufactured from a synthetic foam, means being provided for supporting the cushion against shearing forces.

Fig. 10 shows an embodiment in which the cushion is constituted by a thin-walled hose or bag 25 one edge of which is clamped together with the squeegee blade 2,in a fitting 26 of the fixed portion 1 by means of an inflatable hose 27 known per se from the Netherlands Patent Application 73.04508. The pressure exercised by the inflatable bag or hose 25 upon the strip element 4 provides for an independence between the nip angle α (accounting for the degree of the position) on the one hand, and the pressure force exercised by the strip 4 upon the base (accounting for the degree of penetration) on the other hand. As shown in Fig. 10, the bag 25 is at its upperside in contact with an inclined lower face 28

of the fixed portion 1 of the squeegee.

Fig. 11 shows a variant of the squeegee according to Fig. 10 in that the bag or hose 25 is provided with a side lip 29 which is clamped within the fitting 26 by means of the inflatable tube 27 at a side lying opposite to the clamping zone of the blade 2. The arrows P visible in the Figs. 10 and 11 indicate the direction of travel of the web or strip to be printed by the stencil 3 and the squeegee structure shown in these drawings.

The Figs. 12a, 12b and 13a, 13b show two variants of a structure for mounting the element of synthetic material (the strip 4) upon the tip of the moveable intermediate member (the blade 2) of the squeegee. To this end the blade 2 is provided with a number of protruding lips 30 fitting with much play in a cavity 31 in the strip 4. By means of a resilient filling bar 32, the strip 4 is secured to the tip of the blade 2.

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Claims:

1. Squeegee for pressing a paint-paste through a screen of a printing machine, in particular a rotary screen printing machine for printing a band or web of material, in which the squeegee is mainly constituted by an adjustable fixed portion, a moveable intermediate member and a part which during the printing presses the paint paste through the screen, said part consisting of a material having a low coefficient of friction and a high wear resistance, characterised in that the part of the squeegee intended to co-operate with the screen consists of an element (4) of synthetic material having an invariable shape and a smooth and hard surface, which element is resiliently supported with respect to the fixed portion (1) of the squeegee.

2. Squeegee according to claim 1, characterised in that the element (4) of synthetic material is mounted in or around a fitting which is yieldable with respect to the fixed but adjustable portion (1) of the squeegee.

3. Squeegee according to claim 1 or 2, characterised in that the side of the element (4) of synthetic material contacting the paint-paste is lying substantially flush with the side of the moveable intermediate member (2) directed towards the screen.

4. Squeegee according to any of the preceding claims, characterised in that within the element (4) of synthetic material an insert (4a) of a material with a low coefficient of friction is accommodated (Fig. 6a).

5. Squeegee according to any of the preceding claims in which the element of synthetic material is mounted on a resilient blade, characterised in that the edge or tip of the blade (2) as well as the element (4) are provided with coupling means (30, 32) effecting in co-operation, a locked mounting of the element (Figs. 12, 13).

6. Squeegee according to claim 5, characterised in that the coupling means of the resilient blade (2) consists of a number of protruding lips and in that the element (4) of synthetic material is provided with a cavity (31) one side of which is provided with a groove.

7. Squeegee according to claim 6, characterised in that a profiled locking bar (32) is positioned in the cavity (31) of the element (4) of synthetic material, between the resilient blade (2) and the opposite side of the cavity.

8. Squeegee according to any of the preceding claims, characterised in that a resilient cushion is provided between the element (4) of synthetic material and the intermediate member (2) on the one hand, and the fixed portion (1) of the squeegee on the other hand.

9. Squeegee according to claim 8, characterised in that the fluid pressure in the resilient cushion is adjustable.

10. Squeegee according to claim 1, characterised in the the element (4) of synthetic material is directly connected to the fixed portion (1) of the squeegee.

11. Squeegee according to claim 10, characterised in that the element(4) of synthetic material is pivotally connected to the fixed portion (1) of the squeegee and that a separate resilient device is serving for maintaining the element in its operative position (Fig. 8)

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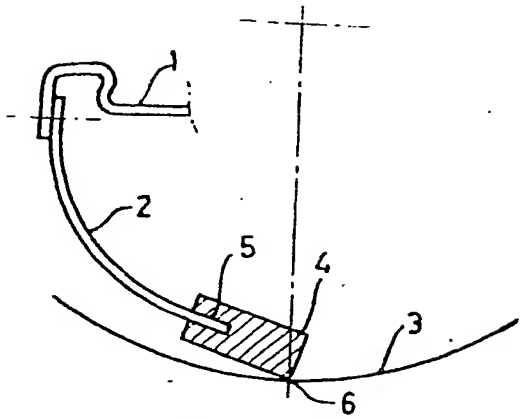

Fig:1.

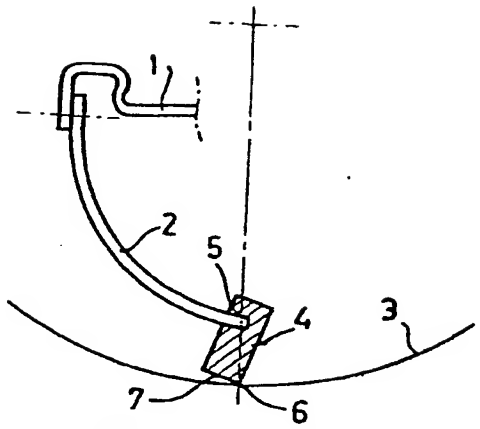

Fig:2.

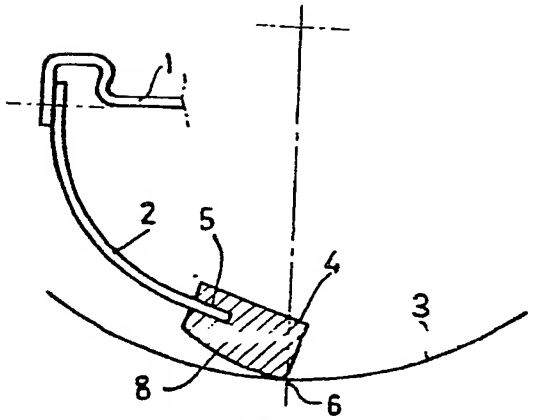

Fig:3.

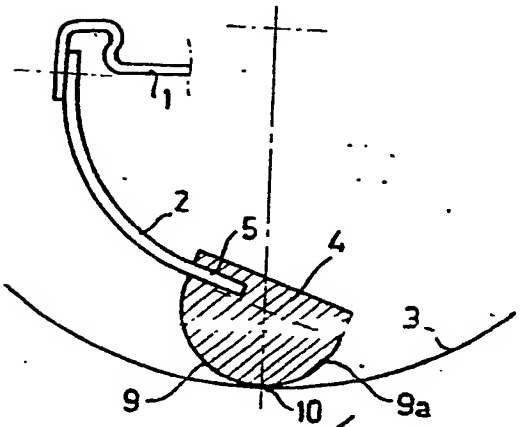

Fig:4.

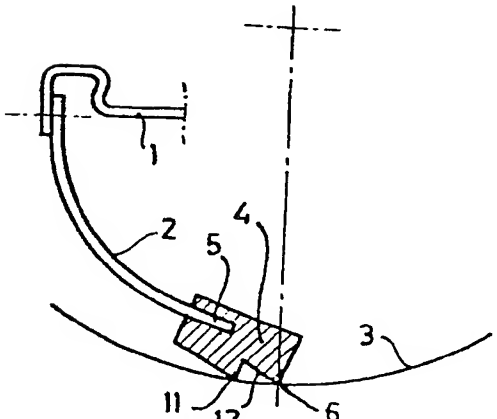

Fig:5.

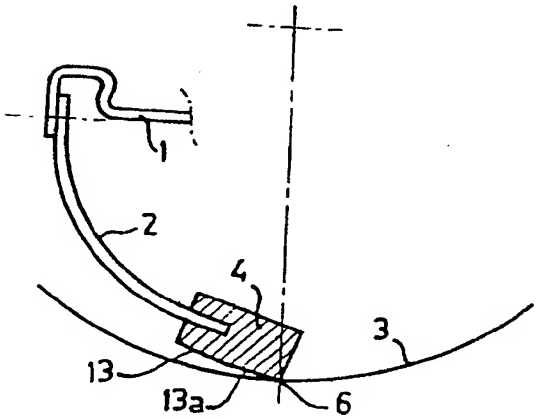

Fig:6.

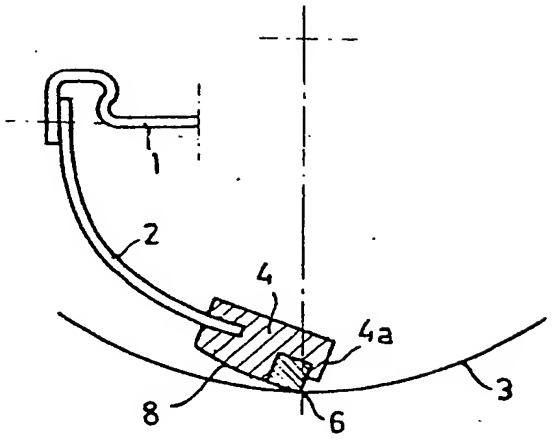

Fig: 6a.

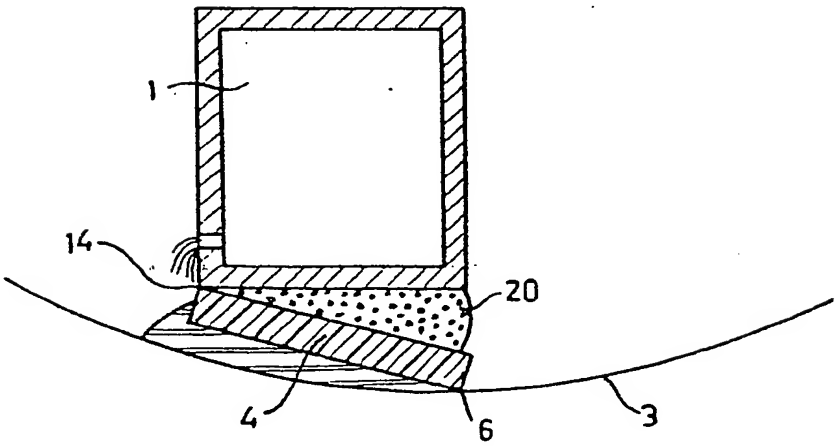

Fig: 7.

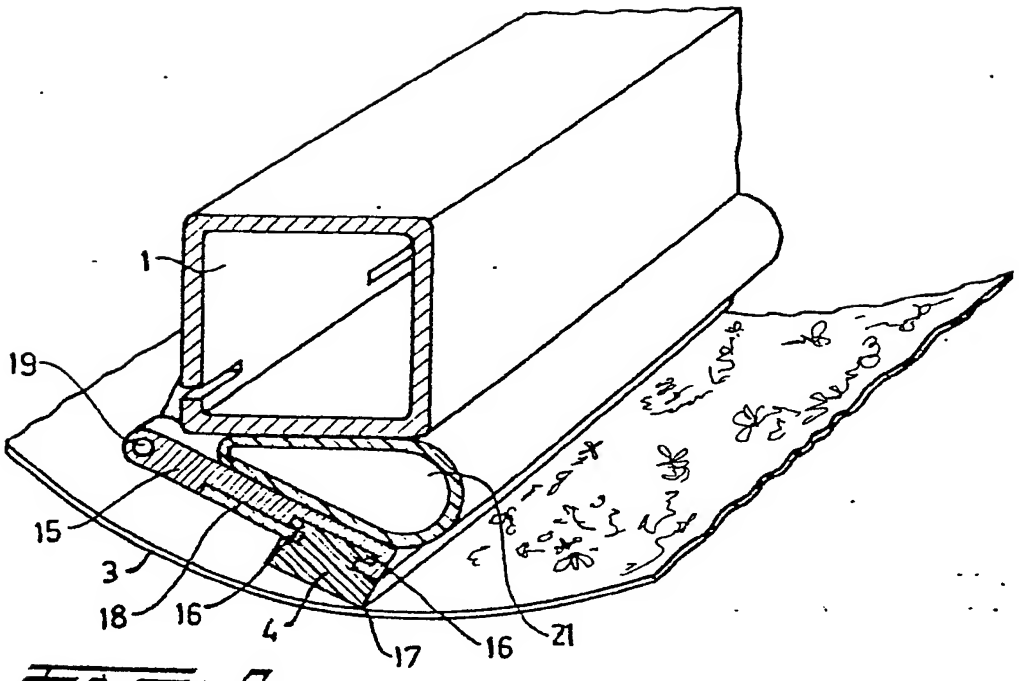

Fig: 8.

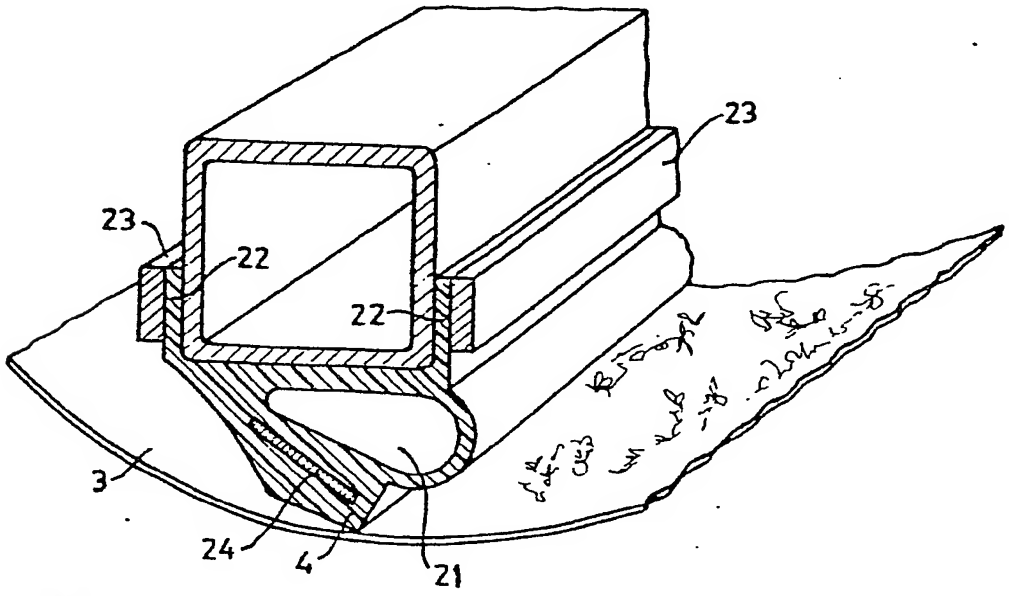

Fig: 9.

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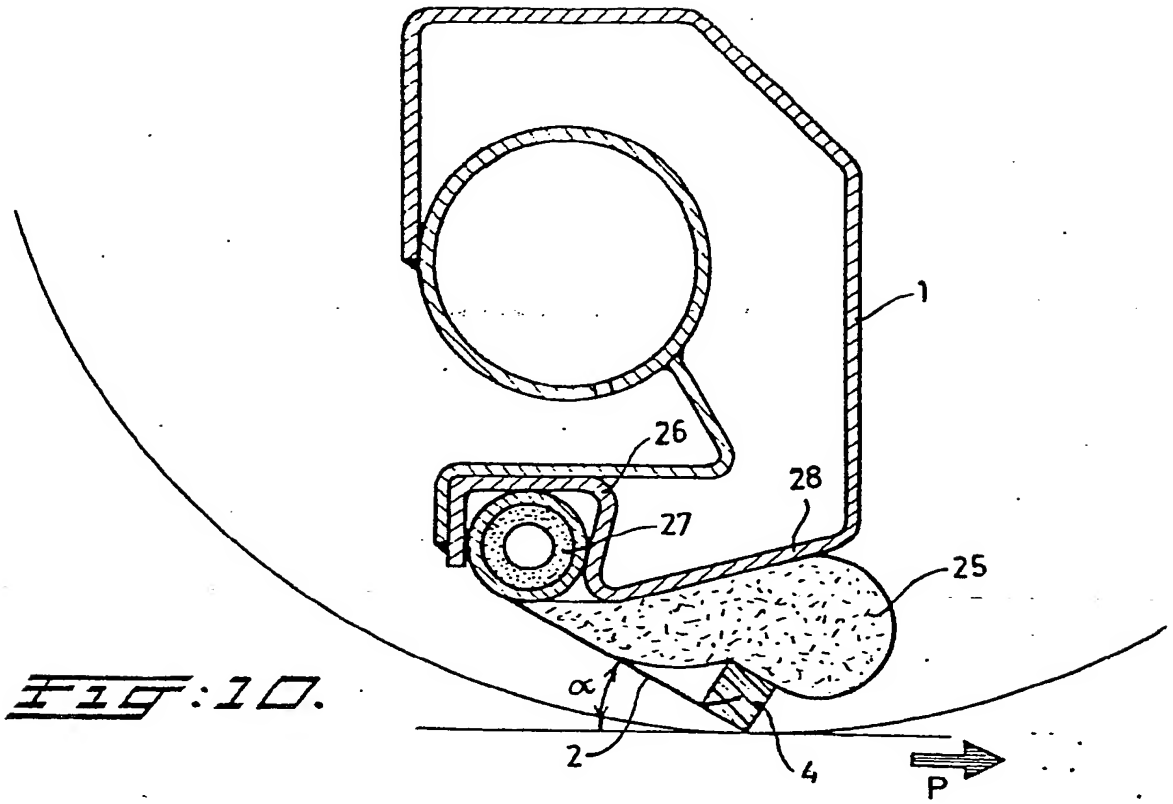

Fig:10.

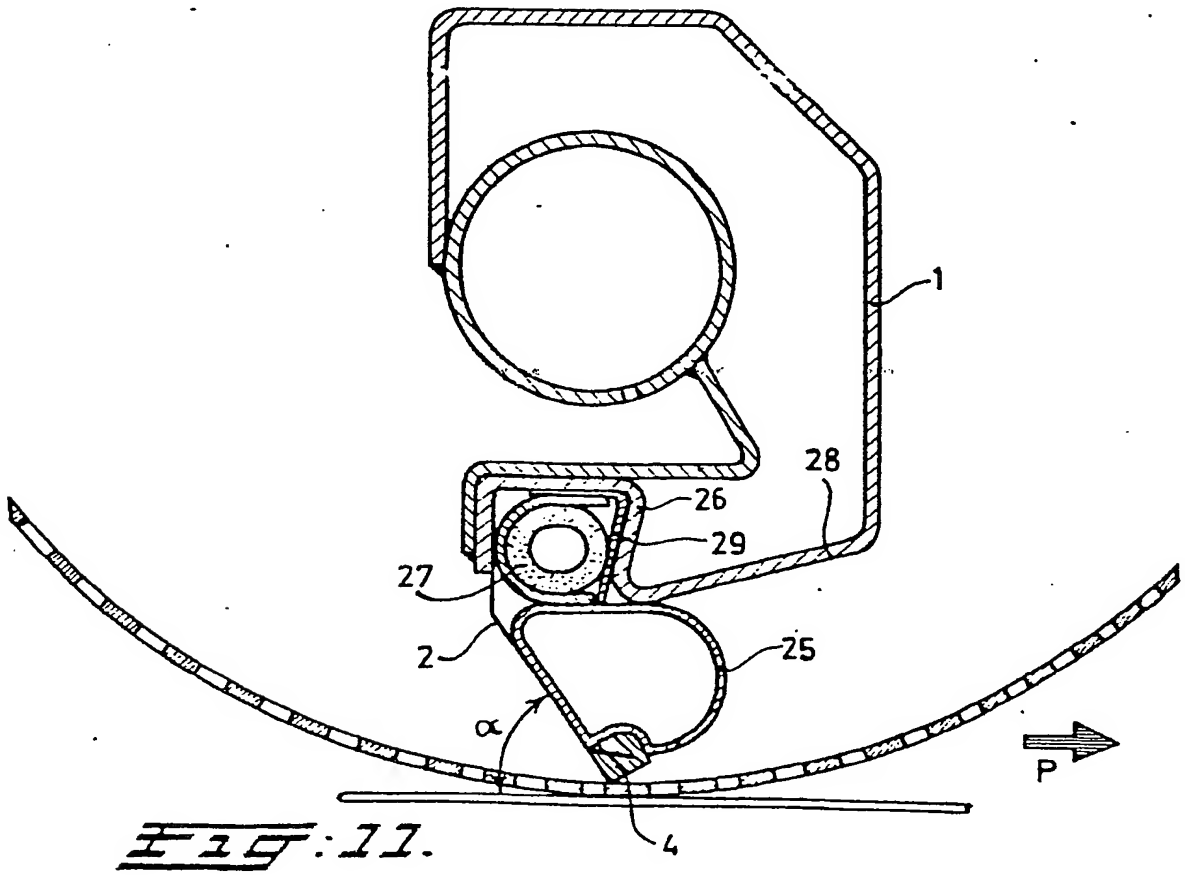

Fig:11.

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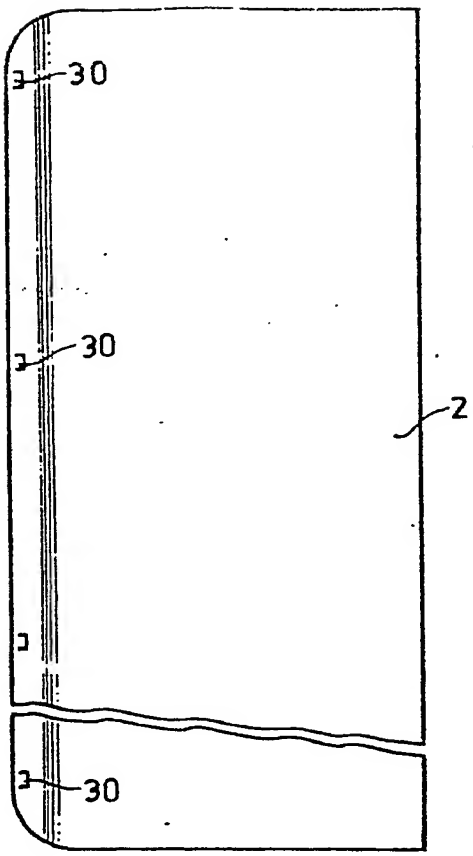
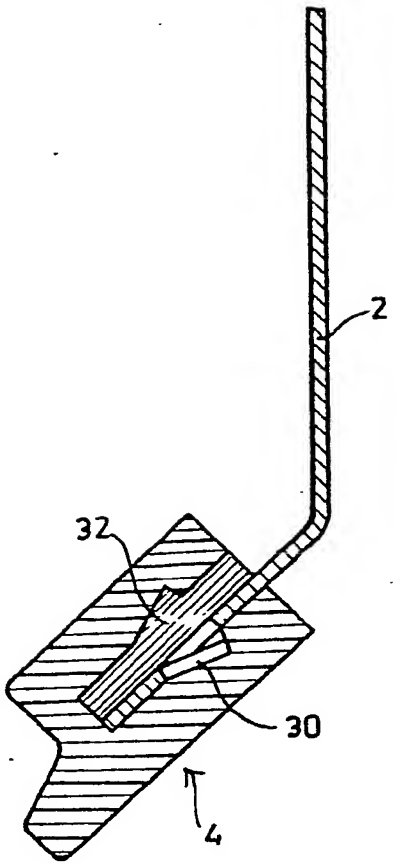


Fig:12A.

Fig:12B.



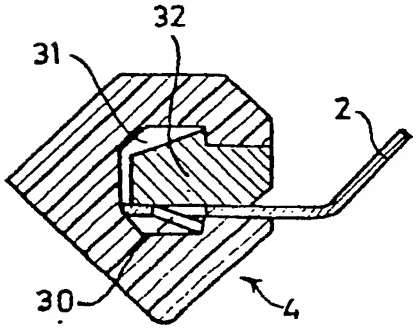


Fig:13A.

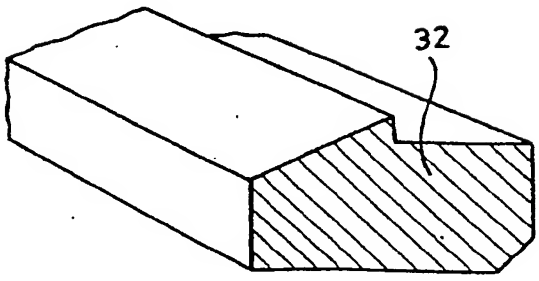


Fig:13B.

European Patent Office

EUROPEAN SEARCH REPORT

0011314
Application number
EP 79 20 0463

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	NL - A - 73 04774 (STORK) * The whole document * & US - A 4 059 756	1,2
X	FR - A - 2 072 885 (MA SCIONI MABETEX) * The whole document *	1,8
X	FR - A - 1 565 286 (ZIMMER) * Page 4, line 38 to page 5, line 16; figures 1 to 8 * & US - A - 3 566 784	1,2,8
X	FR - A - 1 596 780 (WEBER) * Page 6, line 23 to page 7, line 10; figures 4 and 5 * & GB - A - 1 215 200	1,2,3
	NL - A - 73 12093 (STORK) * The whole document *	1,2
	FR - A - 2 074 447 (MITTER) * Page 2, line 13 to page 5, line 25; figures * & US - A - 3 735 730	1,8,9
	US - A - 3 245 377 (GETTEL) * Column 4, lines 4-30; figure 2 *	1,2

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CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

B 41 F 15/44

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

B 41 F
B 05 C
D 21 G

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31-10-1979	MEULEMANS

EPO Form 1503.1 06.78

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	FR - A - 2 157 415 (FELDMUHLE) * Page 6, line 38 to page 8, line 6; figures * & GB - A - 1 410 824 --	1,2,8	
	US - A - 2 861 541 (HORNBOSTEL) * The whole document * --	1,2, 8,9	
	US - A - 3 450 098 (WILLIAMS) * The whole document * --	1,2,5	TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
	US - A - 1 883 167 (VICKERY) * Page 2, lines 68-72; figure 6 * --	5,7	
	FR - A - 2 223 192 (STORK) * The whole document * --	5,7	
	DE - A - 1 916 725 (LODDING) * Page 6, line 11 to page 7, line 11; figures 1,2 * & US - A - 3 529 315 --	5,6,7	
	GB - A - 847 173 (HAROLD ERIC BALIOL SCOTT) * The whole document * --	5,6,7 ./.	

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
DA	NL - A - 73 13509 (STORK) * The whole document * & US - A - 3 998 158 & GB - A - 1 437 756 --	1	
DA	US - A - 3 930 445 (JAFFA) * The whole document * --	8	
DA	US - A - 3 878 780 (LOTTE) * The whole document * --	8	TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
DA	US - A - 3 795 188 (GIANI) * The whole document * ----	8,9	